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EFFECTIVENESS OF RECYCLING INITIATIVES IN THE CITY OF LUSAKA, ZAMBIA

– case of Ng'ombe compound

TURKU AMK
TURKU UNIVERSITY OF APPLIED SCIENCES

BACHELOR'S THESIS | ABSTRACT

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EFFECTIVENESS OF RECYCLING INITIATIVES IN THE CITY OF LUSAKA, ZAMBIA

- case of Ng'ombe compound

The objective of this thesis is to evaluate the effectiveness of recycling initiatives in Lusaka, presenting the case of Ng'ombe compound. The aim is to understand the current situation as well as identify impacts and challenges in order to come up with proposals to improve the system.

Evaluation is made in a qualitative method, interviewing some of the key persons working in the field of waste management in this specific compound. In addition, a quantitative method is considered by utilizing the data of collected recyclables recorded by the company called Resolve Systems Limited.

Mostly, recycling in Lusaka is done after disposal, by waste collectors in the compounds and waste pickers at the landfill. Moreover, some companies have implemented waste separation systems to take care of their corporate social responsibility. System is not ideal yet, but at least the amount of recycling has increased lately.

There are several reasons why the recyclables are not collected. First of all, people do not understand the value of their waste and they are not separating the waste at source. In addition, lack of equipment, lack of space and the low price paid for the collected material makes this business challenging.

In the future, to increase effectiveness of the recycling some new financing would be needed, but there also are some actions that could be made with low costs. The information should be disseminated widely among the people to be able to change the situation and the attitudes.

As a conclusion, the whole recycling system is not too effective yet, but recycling is going forward, and hopefully one day Lusaka becomes a clean and sustainable city with effective recycling and waste management systems.

KEYWORDS:

Recycling, Waste Management, Evaluation, Sustainable Development, Zambia

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KIERRÄTYSPROJEKTIEN TEHOKKUUS LUSAKAN KAUPUNGISSA

- Tapaus Ng'omben asuinalue

Tämän opinnäytetyön tavoitteena on Lusakan kierrätysprojektien tehokkuuden arviointi, keskittyen Ng'omben alueeseen. Tavoitteena on ymmärtää tämänhetkinen tilanne ja tunnistaa kierrätysprojektien vaikutukset ja haasteet, jotta on mahdollista löytää parannusehdotuksia.

Arvioinnissa on käytetty kvalitatiivista menetelmää, haastatellen alueen jätehallinnan avainhenkilöitä. Lisäksi kvantitatiivinen menetelmä on otettu huomioon seuraamalla kerätyn kierrätettävän materiaalin määrän kehitystä.

Suurin osa kierrätyksestä Lusakassa tapahtuu jätteen poisheittämisen jälkeen, jätekerääjien toimesta, joko compound-alueilla tai kaatopaikalla. Lisäksi eräät yritykset ovat perustaneet jätteen erottelujärjestelmiä ottaakseen yhteiskunnallista vastuuta. Tämän hetkinen järjestelmä ei ole ideaalinen, mutta kierrätettävän jätteen määrä on kasvanut viime aikoina.

On monia syitä, miksi kierrätettävän materiaalin keräys ei ole tehokasta. Ensinnäkin, ihmiset eivät ymmärrä heidän luoman jätteen arvoa, eivätkä erottele jätettä lähteen perusteella. Lisäksi haastetta keräykseen tuo tilojen ja tarvikkeiden puutteet, sekä kierrätettävän materiaalin alhainen hinta.

Tulevaisuutta ajatellen, tiettyihin kehitystarpeisiin tarvittaisiin rahoitusta, mutta on myös asioita, joita voidaan toteuttaa pienillä kustannuksilla. Esimerkiksi tietoutta kierrätyksestä tulisi levittää laajalti ihmisten keskuuteen, jotta muutoksia tapahtuisi sekä toiminnassa että asenteissa.

Yhteenvetona, tämänhetkinen systeemi ei ole vielä kovinkaan tehokas, mutta kierrätys lisääntyy ja toivottavasti jonain päivänä Lusakasta tulee puhdas kaupunki, jossa on tehokkaat kierrätys- ja jätehallintajärjestelmät.

ASIASANAT:

Kiertotalous, jätehallinta, arviointi, kestävä kehitys, Sambia

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LIST OF ABBREVIATIONS

CBE	Community Based Enterprise
ECZ	Environmental Council of Zambia
EPCCA	Environmental Protection and Pollution Control Act
HDPE	High Density Polyethylene
LCC	Lusaka City Council
LDPE	Low Density Polyethylene
MSW	Municipal Solid Waste
MSWM	Municipal Solid Waste Management
PET	Polyethylene Terephthalate
PP	Polypropylene
PVC	Polyvinyl Chloride
PS	Polystyrene
SWM	Solid Waste Management
UNZA	University of Zambia
WDC	Ward Development Committee
WMD	Waste Management District
WMU	Waste Management Unit
ZALCO	Zambia Aluminum Copper Company
ZEMA	Zambian Environmental Management Agency
ZMK	Zambian Kwacha

1 INTRODUCTION

This thesis is done for the Waste Management Unit (WMU), Lusaka City Council (LCC) in co-operation with Turku University of Applied Sciences and University of Zambia. Research is made by mixed method approach, qualitative and quantitative.

Recycling is a recovery operation by which waste is reprocessed into new products, materials or substances. Currently, in Lusaka, most of the waste generated ends up to landfill, including a lot of material which has market value and could be re-used and recycled. There exist more than 25 recycling companies which are buying recyclable material but the material is not easily available.

There are certain on-going programs supporting recycling. The aim of this study is to evaluate the effectiveness of the recycling initiatives in Lusaka through a case study of Ng'ombe-compound. In Ng'ombe compound there are different recycling initiatives including Manja Pamodzi -project, Radisson Blue -hotel recycling, Foxdale Court – shopping complex recycling and CBE -recycling. Evaluation of effectiveness has been made based on interviewing key people dealing with the recycling in the Ng'ombe-area and considering the data of collected recyclable material as well as observations made during visits to the area.

The paper will start by general introduction to the waste management, what it means and how it is done. Then moving on to the waste management system in Zambia and more specifically in Lusaka, including also information about legislation and institutional arrangements. Later, basic information about recycling and its importance will be discussed, focusing more on recycling companies and recycling in the city of Lusaka.

In the following chapter, the research method will be explained. Also, case of the Ng'ombe-compound will be introduced. After the background information, the waste management system in Ng'ombe will be discussed, including current recycling initiatives and their operations. Then the collected data will be presented and effectiveness of initiatives will be analyzed. Impacts and challenges will also be identified and analyzed. Moreover, proposed solutions to improve the effectiveness of recycling both in short-term and in long-term will be considered. In the end, main points of the thesis are concluded.

2 WASTE MANAGEMENT APPROACH

2.1 Waste Management in General

Waste is an unwanted or undesired material or substance consisting of unwanted materials that are left over from a manufacturing process or from community and household activities. The material can be discarded or accumulated, stored or treated, prior to being discarded or recycled. (Fullcycle, 2009.)

Solid waste is defined as garbage, refuse, sludges and other discarded substances resulting from industrial and commercial operations and from domestic and community activities. The definition of solid waste includes hazardous waste including waste oils and wastes arising from mining activities but excludes gaseous waste and wastewater. (Environmental Council of Zambia, 2004.)

Waste management means the storage, collection, transport, recovery and disposal of waste. It also includes supervision of operation, after-care of disposal site and actions as a dealer or broker. Managing solid waste is becoming a huge problem worldwide for major countries, due to the rapid increase in waste generation. (Alwaeli 2011, 1.)

The amount of municipal solid waste generated has increased in developing countries 2-3% per year and in developed countries 3.2-4.5% per year. This is caused by continuous rapid population growth, urbanization, industrialization and economic development. (Alwaeli 2011,1.)

The aim of the waste policy in general is to reduce health and environmental effects caused by waste. To achieve the aim, especially following factors should be considered; reducing waste generation, increasing re-use of waste, use of biodegradable waste as well as recycling. Also, energy development from the waste not suitable for recycling could be considered, to ensure undesirable treatment and final disposal of waste. (Suomen ympäristö, 2008.)

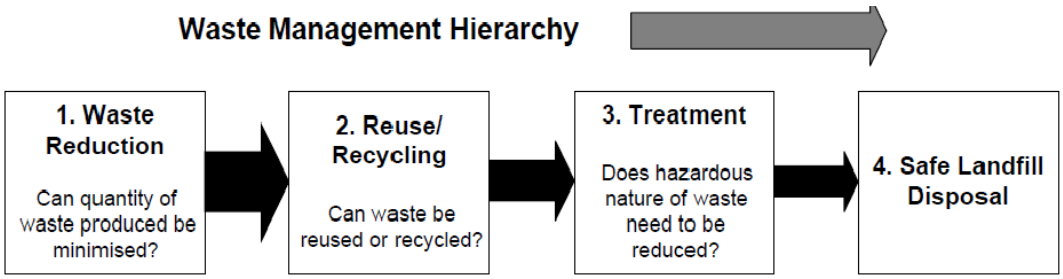


Figure 1. Waste management hierarchy (Environmental Council of Zambia, 2004).

Main points of an effective waste management system are concluded in the Figure 1. above. Firstly, the amount of waste should be reduced. Secondly, the recyclable and reusable material should be separated from the waste generated. Only after these steps, the treatment and safe landfill disposal should be done. (Environmental Council of Zambia, 2004.)

2.2 Waste Management in Zambia

Zambia is a country in Africa with population of 16,717,000 people (2016). Area is 752,612 square kilometers and GDP per capita is 1715 US dollars (2014). Life expectancy for females is 60 years and for males 57 years. Around 67% of population are using mobile phones and 17% are using internet (2014). (United Nations, 2017.)

Zambian economy is based on industry; copper mining and processing, construction, foodstuffs and beverages, agriculture; corn, sorghum, rice, peanuts and exports; copper, cobalt, electricity, tobacco and flowers. (National Geography, 2004.)

The management of waste has been a difficult and challenging issue in Zambia over the years. Poor waste management causes diseases such as cholera, dysentery and pollution, as well as water, air, soil or land contamination, proliferation of pests and vermin and the loss of aesthetic beauty. In this regard the Government of the Republic of Zambia enacted legislation: Environmental Protection and Pollution Control Act (EPPCA) to provide a control of activities related to the environmental protection. (Environmental Council of Zambia, 2004.)

In addition to EPPCA, national waste legislation consists of the Local Government Act, the Public Health Act and the Market Act. The EPPCA is established by Environmental

Council of Zambia (ECZ) and it is a framework law that grants powers to ECZ to develop subsequent secondary legislation i.e. regulations on waste management. (LCC MSWM Strategy, 2003.)

According information given by Lusaka City Council, the ECZ has since been replaced by the Zambian Environmental Management Agency (ZEMA) through the Environmental Management Act No. 12 of 2011.

In every town of Zambia, there is a Council monitoring service delivery of the waste managers and setting minimum standards for the level of service. In addition, they designate and operate waste disposal facilities in accordance to the Environmental Management Act. Monitoring the management and use of waste disposal facilities are also included in their role as well as ensuring compliance with these regulations by waste producers and waste managers within the area. (Government of Zambia, 2011.)

In every Council, there is supposed to be a Waste Management Unit (WMU), which is responsible for activities related to the solid waste management within the area. They appoint waste managers on behalf of the Council in accordance with the Public Procurement Act. Moreover, they advise the Council of preparations and conclusions on solid waste management contracts with waste managers. WMU also publishes information about the solid waste management fees in the gazette and newspaper. They also undertake inspections of the waste management districts or zones. They operate waste disposal facilities according to the requirements by the agency, as well as collect the related fees of solid waste disposal. (Government of Zambia, 2011.)

Simplified organization structure of Lusaka City Council (LCC) is shown in the Figure 2. below. The structure is created based on the information in the webpage of Lusaka City Council (Lusaka City Council, Sample page, 2017). The Public Health department is divided into seven units, one of which is Waste Management Unit (WMU). It includes health inspectors. The health inspectors inspect the contracted waste managers. Based on the information given by LCC, there are currently 16 Franchise companies in conventional areas and 132 Community Based Enterprises (CBE) in Peri-urban areas in the City of Lusaka contracted as the waste managers.

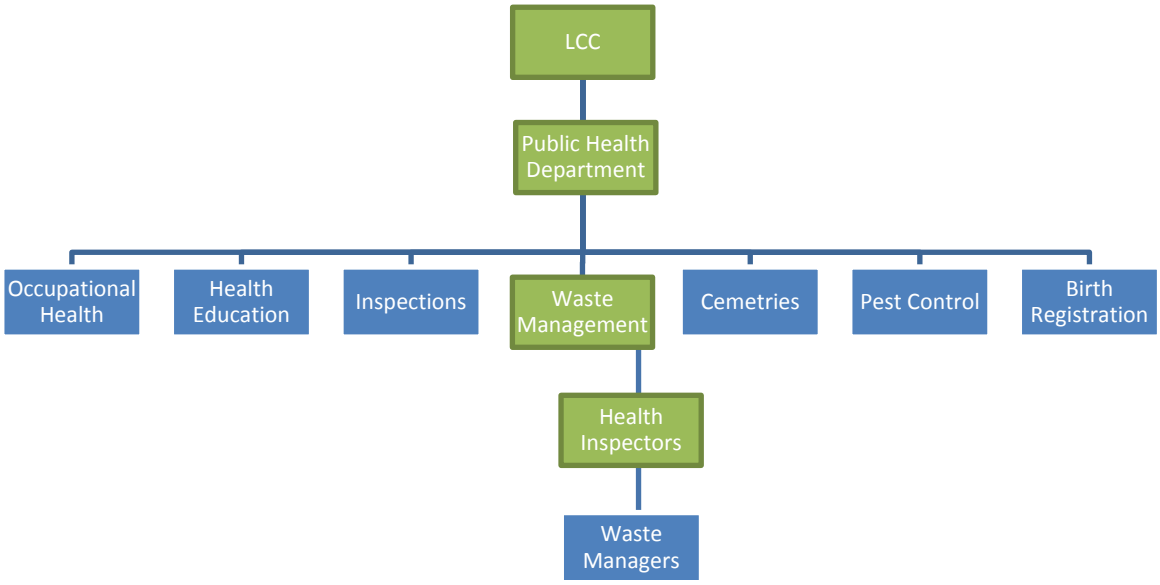


Figure 2. Lusaka City Council organization structure.

Council may be divided into waste management districts or waste management zones, if necessary. The Council appoints inspectors to monitor, inspect and enforce the regulations. Each inspector can enter and inspect any premises, other than the inside of a dwelling house, of any waste producer to ensure regulations are complied with. (Government of Zambia, 2011.)

The Council can engage waste managers for waste management districts, for the purpose of performing its functions. With a contract signed between waste managers and the Council, inspectors ensure that arrangements are adequate for the provision of waste management services. The inspectors enforce the provision of the Solid Waste Management (SWM) regulation. (Government of Zambia, 2011.)

The Council charges waste management fees, which may vary depending on waste management district or zone. The Council, in consultation with other stakeholders, determines fees to be charged for the collection, transportation and disposal of solid waste. The Council or the waste manager may contract any person to collect fees on behalf of them. Fees for the waste management should be paid at designated points and the receipt for each payment is required. (Government of Zambia, 2011.)

Waste producers are supposed to use waste bins or other waste receptacles to store the waste as determined by the WMU. Waste producers are not allowed to place waste next to or on top of waste bins, nor burn waste in a waste bin. Waste producers shall ensure that the surrounding area is always kept free of waste and they shall pay the fee and use solid waste management system established by the Council where such a system is in operation. Waste bins are required to be placed near the entrance of waste producers. (Government of Zambia, 2011.)

Waste producers are not allowed to dispose waste in open spaces, or places that are not designated as a waste disposal facility. Disposing and burning the waste in an open fire and burying waste on private or public land is also prohibited, as well as digging a pit for purpose of waste disposal. It is not allowed either to keep or accumulate waste on premises beyond the regular collection period, deposit or place waste in any street, storm water drain premises, water course, reservoirs, forest or any place not intended for waste disposal. (Government of Zambia, 2011.)

Moreover, throwing waste from moving or stationery conveyance is prohibited, as well as using accessories for any purpose of waste disposal that is not approved by the Council. Loitering and scavenging at waste disposal facilities is forbidden too. In addition, people are not allowed to provide waste management services without a license from the Agency and a solid waste management contract with the Council. Any person who does not follow the regulations gets penalty. (Government of Zambia, 2011.)

It seems that despite the regulations, the waste disposal is not under control in Zambia. Huge population growth in Zambia has made waste management difficult. In 2000, the population of Zambia was 9.887.591 inhabitants but increased rapidly, 32.4% in ten years, and in 2010 population was already 13.092.666 inhabitants (Zambia Index, 2017).

When the number of people increases, also the amount of waste increases. That is one reason for the challenges in the field of waste management; it is difficult to provide effective waste collection system for developing and changing environment. Since the collection system is not functional, people avoid paying fees and dump their waste illegally for example to drains, open areas or burn or dig pits. Below in Picture 1. is shown one example of current waste disposal behavior. In this case, there was a pit at the backyard of one house and it was emptied to the street illegally.

Picture 1. Illegal waste disposal.

Regulations sound effective, but still waste is not well managed in Zambia, as the regulations are not effectively enforced. There are several challenges regarding the waste management in the country, and some of those are later introduced more specifically related to the situation especially in Lusaka. Other cities have similar problems but situation seems to be worse in the capital.

2.2.1 Waste Management in Lusaka

Lusaka City is the capital of Zambia and one of the fastest developing cities in Southern Africa. It is situated in the central part of Zambia and population density is 4.853,2 persons per square kilometer. (Lusaka City Council, About Lusaka, 2015.)

Total population is around 1,7 million and average size of household is 5,5 persons per household. Most of the population, 67%, live in peri-urban areas. In Lusaka, less than 40% of population is using and paying for the waste collection. (Mulwanda E., 2017.)

Lack of proper waste management system is a problem for the inhabitants of the City of Lusaka. Poor solid waste management is attributed to insufficient funding which leads to inadequate logistics such as needed vehicles for effective solid waste management. (LCC MSWM Strategy, 2003.)

According to reports, only 36% of total waste generated is collected (LCC-WMU Final Report, 2014). This means that there is no waste collection offered to some households and 64% of total waste is either burned or disposed illegally in drains and open areas causing visual nuisances as well as land and air pollution. An example of illegal dumping in Lusaka is shown in the Picture 2. below.

Picture 2. Example of illegal dumping in Lusaka.

A Waste Management Unit (WMU) has been established into Lusaka City Council and that is mandated to plan, organize, execute and supervise waste management services in the City, and the management of the disposal site. The WMU is supposed to operate in a cost neutral manner which means that it shall generate sufficient funds to pay for all

the expenditure required to provide an efficient and affordable waste collection and disposal service in the entire city. (Lusaka City Council, Waste Management, 2017.)

One of the functions of the WMU is the management of the disposal site which is located in Chunga (Lusaka City Council, Waste Management, 2017). Mostly all the waste that is collected, ends up at the Chunga landfill. Daily an average of 350 tons of waste is collected from the City of Lusaka and dumped there (Mulwanda E. 2016). Currently the disposal site is not managed the way it should be. Environmental protection systems in the landfill are lacking, which means that the site contaminates its surroundings (LCC MSWM Strategy, 2003).

Based on the reports of the LCC, at least two compactors would be needed in the landfill, but currently there is only one, which has been broken for over two years. Upon visiting the landfill, it can also be seen that the site is surrounded by houses. People have built houses all over the site and they are living under a serious health risk because of the landfill. It is not a healthy environment to live in due to the diseases caused by pollution. Below in the Picture 3. the landfill is shown.

Picture 3. Chunga landfill.

In addition, the WMU is taking care of the waste registration and charging the fees for the waste disposal. Also, the collection of waste and related fees from the central business district is in their responsibility. The waste collection system is a little different in peri-urban and conventional areas.

In peri-urban areas the WMU has partnered with Community Based Enterprises (CBEs). The CBEs take care of day-to-day solid waste collection from households, business premises and other premises in the area where they operate. The LCC monitors and supervises CBEs, sets the collection fees for CBEs and enforces the laws governing solid waste management. CBEs responsibilities are to ensure that solid waste generated in the settlement is collected, they also collect the waste fees and ensure that the secondary solid waste collection is paid for. In addition, CBEs are supposed to conduct community awareness and educational programs on solid waste management system. Residents need to maintain and promote hygiene and cleanliness by managing solid waste at the source by storing waste into the bins, paying for the solid waste collection to CBEs and reporting the inefficiencies of CBEs to the council site office. (Waste Collection Services for Peri-Urban Areas, 2017.)

Currently there are a total of 132 CBEs working around the city and plans are to add 40 CBEs more to help with waste collection (Mulwanda E., 2017).

In conventional housing and commercial areas, the WMU has established partnerships with private waste management companies. The city has been divided into 16 Waste Management Districts (WMD) and in each district, franchise companies have been contracted to do the waste collection. These contractors are responsible for collecting and transporting solid waste from all the premises in WMD. In addition to that, they collect the fees for the services provided. They should also encourage the use of appropriate solid waste storage receptacles (refuse bags, bins or containers) and promote separation of solid waste by source. The LCC is monitoring and supervising franchise contractors as well as setting the collection fees for the contractors. In addition, they enforce laws governing the solid waste management. Also in conventional areas, residents need to maintain and promote hygiene and cleanliness by managing solid waste at source by storing to the bins, paying for the solid waste collection to the franchise contractors and reporting the inefficiencies of the franchise contractors to the council site office. (Waste Collection Services for Conventional areas, 2017.)

Currently there are issues with waste collection due to inadequate amount of equipment needed. The number of vehicles existing and required to provide the collection in Lusaka area can be seen in the Table 1. below. Based on the data, 58 vehicles would be needed in order to offer effective waste collection. Currently, there are only 18 vehicles operating. This means that only about 30% of the needed vehicles exist.

Table 1. WMU vehicle inventory (LCC Consolidate Data, 2016).

WMU Vehicle Inventory		
	Existing	Required
Tipper Trucks	5	10
Tractors	2	10
Compactor Truck	4	10
Vacuum Tanker	1	5
Light Trucks	2	10
Skip Loader	1	5
Hook Bin Truck	3	8

When talking with the residents, it also seems that people are not willing to pay the fees due to the ineffective system. According to the LCC final report, 2014 less than 40% of people are using the waste management services and paying the fees. That causes many problems, like illegal dumping and financial challenges for the collection companies.

One function of the WMU is the inspection of all waste management activities and enforcement of waste management regulations, or waste management by-laws. They also develop and oversee the implementation of long-term solid waste management plans on behalf of the LCC, including resource mobilization for capital projects and institutional support. (Lusaka City Council, Waste Management, 2017.)

On the streets, it is clearly visible that the enforcement of the law is not as good as it should be. The city is not clean and there is waste on the streets wherever you walk by. It seems that the WMU has no capacity, transportation and resources to inspect all the areas.

In addition, the WMU provides direction on implementation strategies for the future and conducts periodic environmental audits of the existing SWM strategies. The WMU shall also advise management on policy matters relating to the solid waste management in City of Lusaka. They also maintain contracts with all waste generators, but especially with those waste generators that have a direct relation with the WMU through a contract or memorandum of understanding. (Lusaka City Council, Waste Management, 2017.)

It can be said that strategies are not up to date. Latest strategy was written in 2004, i.e. 13 years ago. Describing the current situation is challenging since the information available is not up to date.

According to Mr. Mulwanda, to accomplish good waste management practices, more awareness need to be raised. Also, the enforcement of the law should be improved in order to make waste generators to use the system developed by the Council, and to pay for the services. Additionally, private public partnership should be strengthened. Moreover, the Council needs financing for cleaning up the accumulated waste and for the enforcement of the by-laws preventing re-accumulation. (Mulwanda E., 2017)

3 RECYCLING

Recycling is a recovery operation where waste is reprocessed into new products, materials or substances for the original or other purposes. Recycling operation consists of few phases; collecting and processing recyclable materials, manufacturing recycled content products and purchasing recycled products. These phases create a circle which ensures the value of recycling. (Alwaeli 2011, 23)

The cycle of recycling phases is shown in the Picture 4. below. It is endless cycle where products go through from consumers to collection and reprocessing and back to the consumers again over and over again. (Afs Recycling, 2008.)

Picture 4. Recycling cycle (Afs Recycling, 2008).

3.1 Importance of the Recycling

Recycling has become an urgent and important matter because landfills are getting full, additional waste products are polluting our forests, beaches, oceans and other natural environments. Recycling helps turn garbage into useful material and keeps the environment clean, reduces the amount of waste in landfills and provides more cost-effective materials when it comes to manufacturing new items. (Save the World, 2009.)

Waste constitutes a potential source of secondary materials and fuels. Recycling has environmental and financial benefits and is a key to solve problems being caused by our consumerist lifestyle. Some of the natural resources are limited and might be exhausted one day, like fossil fuels and ore metals. Utilizing waste and recycled products instead of wasting limited natural resources, will mitigate the problem. (Alwaeli 2011, 58-59.)

Non-biodegradable products release toxic gases during manufacturing and due to the improper disposal of material. Recycling reduces air pollution by reducing the conventional waste disposal and decreasing the amount of greenhouse gas emission in comparison to the virgin production. By recycling, our planet can be saved, since lowering the greenhouse gas emissions, also climate change will be curbed. (Alwaeli 2011, 58-59.)

There are also financial advantages when it comes to recycling. When less waste ends up to the landfill, communities will save on their waste disposal costs. Also, sales of recycled materials will bring new businesses and more incomes to the communities. (Alwaeli 2011, 59.)

Informal waste recycling is a usual way to earn income for the poor people in developing countries. According the studies, in addition to creating jobs and reducing poverty, waste picking can save money, improve industrial competitiveness, conserve natural resources and protect the environment. About 1 % of urban population in developing countries survive by collecting recyclables from the waste. This means more than 15 million people around the world choose picking the waste instead of starving. (World Bank Group, 2016.)

3.2 Recyclable Material

Most common recyclable materials are plastics, paper, cardboard and metals. The materials are processed into bales at a material recovery facility. After that those will be recycled into new products at recycling plants. (Mohee & Simelane 2015, 19.)

Paper

Main types of paper that can be recycled are; office white paper, newspapers, magazines, cardboard boxes and cartons, mixed and colored paper and computer printout paper. (Alwaeli 2011, 33.)

Waste paper is graded into different categories based on quality: ordinary grades, medium grades, high grades, craft grades and special grades. Reprocessing is made depending on the grade of the paper and the end use purpose. Higher grades of the paper need less processing. Lower grades need to be processed more and those are more commonly used for packaging material. Technically it is possible to make new products entirely from secondary fiber but it is not possible to produce higher quality products out of lower quality waste material. (Alwaeli 2011, 34-35.)

The lifespan of products made of paper is usually only from few days, (e.g. newspapers), to a few weeks (e.g. packaging material). Paper and cardboard products are mostly made from cellulose which is harvested from plantations and forests. Since the product's lifespan is so short, it is important to recycle the paper and this way reduce the consumption of wood and save forests. Every ton of recycled paper saves 2,5 barrels of oil, 4100 kWh of electricity, 4 cubic meters of landfill, 31,780 liters of water and 13 trees. (Alwaeli 2011, 33, 36.)

Metal

Iron and steel are world's most recycled materials and among the easiest materials to reprocess. One advantage compared to the other recyclables is that those can easily be separated magnetically from the waste stream. Household waste includes estimated 5-10% metals, which are mainly tin plated steel cans for drinks, tinned foods cans and aluminum drink cans. (Alwaeli 2011, 37-38.)

Any grade of steel can be recycled to top quality new metal, due to the property of steel being recyclable repeatedly. Even 42% of crude steel is produced out of recycled material. As a steel work process, scrap is either remelted in an electric arc furnace or used as part of the charge in a basic oxygen furnace. (Alwaeli 2011, 37-38.)

Aluminum is one of the most efficient and widely recycled materials among non-ferrous metals. Reason for that is the high price, the economic value of aluminum and the industry's infrastructure support. Recycled aluminum accounts one-third of global consumption of aluminum and it has been recycled since the days it was first commercially produced. In a recycling process aluminum is firstly either crushed into bales or shredded and ground into small pieces. Then the pieces or bales are melted in an aluminum smelter to produce molten aluminum. The recycling process is much more energy intensive and low-priced process than creating new aluminum from bauxite. (Alwaeli 2011, 37-38.)

Every ton of recycled packaging steel saves 1,5 tons of iron ore, 0,5 tons of coal, 40 % of water required in production and 75% of the energy that would be needed in virgin material production. Recycling 1kg of aluminum saves up to 6kg of bauxite, 4kg of chemical products and 14kWh of electricity. Also, re-melting of aluminum can save up to 95% of the energy that would be required in the primary process. (Alwaeli 2011, 39.)

Scrap metal, or in other words secondary metal processing, is one of the most recyclable products. Recycling is done by melting down scrap metals and reusing those in the new production. Secondary metals are from industrial operations and from manufacturing of metal shapes and products, or post-consumer products from waste stream. (Alwaeli 2011, 38.)

Plastics

Plastic is most common packaging material due to its light weight and low cost. Also, advantage of plastic is that it can be manufactured in many ways, different shapes and sizes. Plastics are mostly used in packaging, for example in bags, sacks, wraps, soft drink, milk and water containers. In addition, plastics are used in other products, like furniture and appliances. (Alwaeli 2011, 39.)

Plastics are organic polymeric materials consisting of giant organic molecules. Those are divided into thermoplastics, which are linear polymers and branched polymers, and to thermosetting, which are cross-linked polymers. (Alwaeli 2011, 39.)

Approximately 80% of plastics are thermoplastics. These include for example polyethylene terephthalate (PET), polypropylene (PP) and polyvinyl chloride (PVC), polystyrene (PS), high density polyethylene (HDPE) and low density polyethylene (LDPE). Thermoplastics are used mostly in packaging but also in textile fibers and coatings. Thermosets are for example polyurethane, epoxy and phenolic. Thermosets are hardened and cannot be re-melted or re-molded, which means that those are difficult to recycle. (Alwaeli 2011, 40.)

Roughly 100 million tons of plastics are produced each year and plastics packaging totals 42% of total consumption of which very little is recycled. Recycling of plastics requires more processing than for example glass and metal. First, types of plastic need to be sorted before recycling. Plastic recycling includes four different types of processes; primary, secondary, tertiary and quaternary. (Alwaeli 2011, 40-41.)

Glass

Waste glass from households is usually bottles, broken glassware, light bulbs and other items. In glass production, sand, soda ash and limestone are the three principal raw materials. Even though the raw materials are relatively cheap, glass making is costly because it is energy intensive. By recycling, is possible to reduce the energy used, since recycled glass melts at lower temperature than the primary raw materials. (Alwaeli 2011, 42,43.)

In the glass' recycling process, firstly collected glass cullet is taken to a recycling plant. There it is monitored for purity and contaminants are removed. Then cullet is crushed and added to a raw material mix in a melting furnace. It will be then molded or blown mechanically into new jars or bottles. (Alwaeli 2011, 43.)

Glass recycling reduces CO2 emissions. Since recyclable glass does not contain carbonates, it does not release any CO2 during the melting process. Glass recycling process also consumes less fuel, because recyclable glass is easier to melt than individual raw materials. Each ton of glass returned to melting furnaces reduces glass industry's demands for new raw materials by 1,2 tons. (Alwaeli 2011, 44.)

Other waste

Amount of electrical waste is increasing remarkably nowadays. The importance of electrical and electronic equipment recycling is growing. (Alwaeli 2011, 46-47.)

Biowaste is biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants. (Alwaeli 2011, 47.)

Composting of biowaste could be a cornerstone of sustainable development neglected in the municipal Solid Waste Management (SWM) programs. Over 50% of the Municipal Solid Waste (MSW) in developing countries could be readily composted, by diverting organic materials from open dump sites. Composting can improve existing recovery rates of recyclable organic and inorganic waste. (Mohee & Romela, 2015, 58.)

3.3 Recycling in Lusaka

Waste recycling has become a booming business in the City of Lusaka and people are collecting and selling the empty bottles and used sacks to manufacturers (Lusaka Voice, 2014).

Despite the news, it seems that people are not aware of the value of their waste and recycling in general, so they do not separate waste at the source. Further, there is no waste containers visible on the streets so that people could separate the waste, if they were willing to do that. This means that almost all the waste generated ends up to the landfill.

Based on observations and conversations, since there is no separation at the source, people, called as waste pickers, are working at the landfill and picking up the waste. It has been told, that there are currently more than 500 waste pickers at Chunga landfill. They have their specialties and they collect recyclable waste (plastics, glass, sacks, metal etc.) among all the other waste. Once they have recyclable material collected, they sell it either straight to the recycling companies or to the aggregators, who supply materials to the recycling companies. Waste pickers at Chunga landfill collecting recyclables can be seen in Picture 5. below. In the Picture 6. recyclable material collected into piles is shown.

Picture 5. Wastepickers collecting materials at Chunga landfill.

Picture 6. Collected recyclables.

From the landfill, only 2% of the waste ending up there is recovered. Plastic bottles, other plastics and sacks are the most common collected materials and those provide in total 59% of all the recyclables collected from the landfill. In the Figure 3. below is the classification of recovered materials. (LCC-WMU Final Report, 2014.)

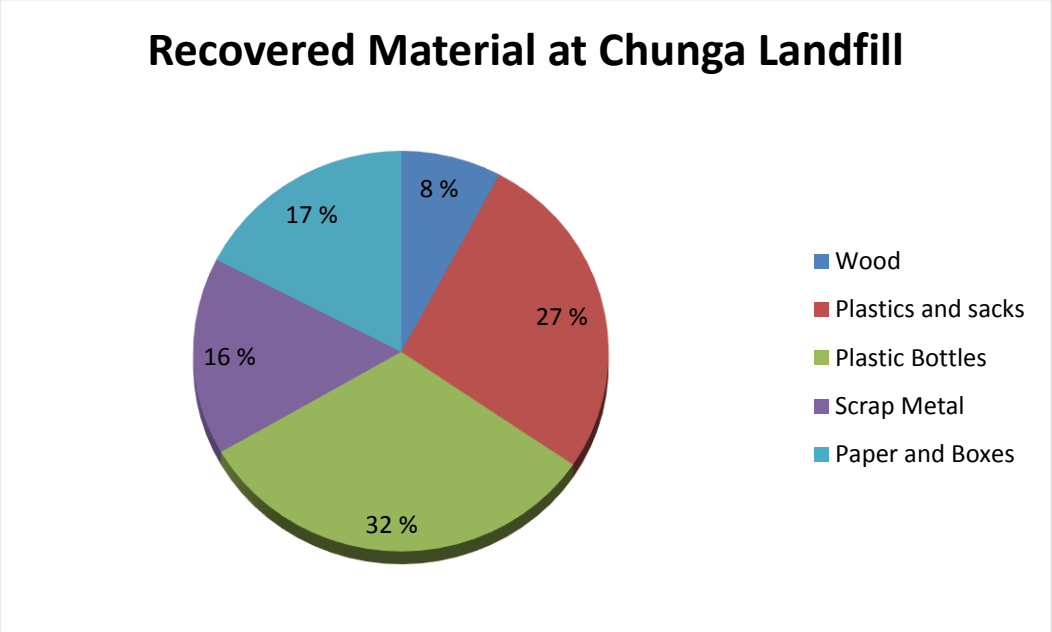


Figure 3. Recovered material at Chunga landfill (LCC-WMU Final Report, 2014).

In addition to the separation at the landfill, it seems that there are some additional aggregation places around the city, where people called collectors, collect recyclables from streets, markets, drains etc. They also separate recyclables at the source and sell those to the aggregators, who supply materials to the recycling companies.

Based on observations, there have been some projects to increase the awareness of the recycling among the people in order to develop the environment as well as the recycling industry. Lusaka City is going to the right direction, but there is still a lot to do to make people understand the importance of recycling.

3.3.1 Recycling Initiatives

Based on conversations and observations, government is not focusing on increasing awareness of the recycling for example by teaching it at the schools. That is the reason why recycling in Lusaka is mostly driven by private sector.

Some companies have tried to implement recycling programs to take care of their corporate social responsibility. Also, it has been told that Zambian Environmental Management Agency (ZEMA) will be establishing laws that companies need to start recycling the waste they generate. Moreover, CBEs who are responsible for primary waste collection in the peri-urban areas are also interested in implementing recycling programs. They would prefer to collect household waste separated or separate the waste after primary collection by themselves.

There are several people trying to increase recycling through different kinds of initiatives. Most of the initiatives are small and have not made so much change for the city. Biggest recycling initiative in the city that has made a significant impact is Manja Pamodzi.

Manja Pamodzi

Manja Pamodzi is a recycling initiative initiated by Zambian Breweries helping to manage the post-consumer packaging material. Project is jointly funded by the Millennium Challenge Account Zambia's Innovations grant and supported by the Lusaka City Council. Objective of the project is to clean the Lusaka City in next five years through promotion of collection and recycling. The project focuses on especially collection of recyclable material such as plastics, glass and paper which have a market already. (Mulwanda E., 2017.)

The project arranges district clean-ups, where volunteering people are divided into teams and they collect as much recyclables as possible in certain time. Later, the best collectors will be awarded and people are paid for their effort depending on the amount of collected recyclables. People can register as collectors and keep collecting waste any time even after the district clean-up.

Picture 7. District clean-up, waste separation.

Picture 8. Manja Pamodzi campaign in Chunga- compound.

Manja Pamodzi district clean up in action in Chunga compound 4th of March 2016 can be seen in the Pictures 7. and 8. above. In the Picture 7. Manja Pamodzi workers are separating the recyclables at source after the collection. The Picture 8. shows the stage from where the clean-up was organized and people were encouraged to participate in collection.

According to Mr. Mulwanda, aggregation centers in different parts of the city has been established by Manja Pamodzi. There the aggregator buys the recyclables from collectors. By using the aggregation centers, the amount of waste that ends up to the landfill decreases. Further, people learn waste separation at source and find out the market to sell their recyclable materials. (Mulwanda E., 2017.)

Manja Pamodzi is a sustainable project taking care of social, economic and environmental aspects. People see waste as a resource which can bring income to them instead of seeing it only as a waste. Project also reduces indiscriminate disposal of solid waste polluting the environment. (Mulwanda E., 2017.)

3.3.2 Recycling Companies

In Lusaka, there exists currently more than 25 companies in the recycling industry, according to LCC reports. Based on the company visits, there are not many local Zambian companies operating in the industry in Lusaka and most of the companies are owned by Chinese. In addition, there are for example Lebanese and Indian companies operating.

It seems that the most wanted recyclable materials are plastics and sacks but also recycling paper and metals are bought. The companies may collect recyclables by themselves using own vehicles, or they buy the materials from aggregators. Some of the biggest companies are shortly introduced in following chapters.

Company called City Waste Solutions is collecting paper, egg trays, cardboard, plastic wrapping, bottles and big metal items for free from anywhere in Lusaka. Waste can be collected from homes or companies, but it must be separated. Collection can be organized as a one-time service or on a regular basis. (Eco Zambia, 2016.)

Champions Recyclers is a recycling company that also offers free collection from anywhere in Lusaka but they have set minimum amounts for some of the materials. They

collect cans (aluminum and steel), plastic bottles (PET, Maheu and HD), soft plastics, paper and cardboard and mealie meal sacks. (Eco Zambia, 2016.)

Zambezi Paper Mills operates in Lusaka and in Kitwe. They buy recyclable paper and cardboard, and those can be delivered to their yards in Lusaka and Ndola. They produce toilet paper, craft paper, egg trays and packaging. (Eco Zambia, 2016.)

Zambia Aluminum Copper Company- ZALCO, also known as Central Recycling, focuses on transforming waste paper and scrap metal into reusable items. They recycle paper, cans, car batteries and non-iron devices. Recyclable paper and cardboard can be delivered into their offices in Lusaka and Kitwe. (Eco Zambia, 2016.)

Below in the Picture 6 is shown material produced from collected recyclables plastics. The products are produced by one recycling company located in Zambia.

Picture 9. Products made of recyclable material.

4 RESEARCH METHOD

4.1 Purpose of the Research

The objective of the research is to evaluate the effectiveness of recycling initiatives in Lusaka City. More specifically, purpose is to understand the current situation and identify the changes and impact the initiatives have made in the recycling system. Another aim is also to find out ways to improve recycling even more in Lusaka. The case of Ng'ombe compound was chosen to keep the focus on a specific area and to completely understand actions there, but the findings and proposals may be relevant for the other areas and compounds as well.

In order to achieve the aim, the purpose of this work is to present clear understanding and definition of the current system in Ng'ombe. Firstly, the background information of the waste management system in Ng'ombe is clarified. Furthermore, it is important to observe what kind of recycling initiatives exist and how recyclables are collected, to be able to evaluate those.

One of the main goals is to find out, not only the impacts, but also challenges that exist, so that the system could be improved. Based on the findings, some easy to implement quick solution proposals for the current system are made. Also, long-term goals to improve the recycling effectiveness are considered in order to understand what is needed to build a more developed system.

Research questions:

1. What kind of recyclables are collected, how and how much in Ng'ombe-compound?
2. What are the impacts and challenges of the recycling initiatives to the economic, social and the environmental aspects?
3. How to make recycling in Ng'ombe more effective?

4.2 Research Method

There are many ways of evaluate the effectiveness, and in this research effectiveness was evaluated mainly by qualitative method and a little bit of quantitative method as well.

The evaluation was made based on interviewing people working in the field of waste management and recycling in Ng'ombe-compound, considering also opinions given by the residents. Qualitative method, and just few key people to interview, was chosen considering the fact that time spent in the country was relatively short and it was considered to be the most reliable way to get information about the current situation, impact and existing challenges.

In addition to the qualitative method, also quantitative method was considered. It was done by presenting the numbers of collected recyclables from Ng'ombe compound and development of the amount of collected recyclables during the on-going programs.

First interviewed person was Mr. Henry Kalolo, a social entrepreneur. He has been working in the field of waste management over ten years and has a company called Resolve Systems Limited. He is an aggregator and has a buy-back center for recyclables. In addition to that he is running a recycling project at the Radisson Blue-Hotel, which is very close to Ng'ombe, and also he does composting of organic waste.

Next interviewee was Ms. Beatrice Kafue. She is Director of Kutwane Solid Waste Management (CBE) and has been working in the field of waste management since October 2006. She is managing primary collection of waste in one area of Ng'ombe compound with target to increase recycling activities in the compound.

Third person interviewed was Mr. Moses Mulenga, Cleansing Supertendent. He works for Lusaka City Council (LCC) and his role in Ng'ombe is to support waste management and recycling organizations, monitor the activities and conduct performance assessment. He has been working in the field of waste management for five years.

By interviewing these three persons it was possible to get clear overall picture of waste management and recycling activities in Ng'ombe compound since they are the main influential persons when it comes to the waste management issues in this area. It was also important to get opinions from people representing different companies and organizations.

To improve the overall picture of the recycling effectiveness and impacts to the compound even further, also residents' opinions were taken into a consideration. This was done by interviewing three randomly chosen people.

In addition to the interviews and numerical data, a lot of information gathering was needed in order to accomplish the research. Information was gathered beforehand by gaining general knowledge of the waste management and recycling from literature and internet. In order to understand the system in Zambia and especially in Lusaka, the information of the current system was gathered based on observations, conversations and studying the LCC documents and strategies. In addition, several related researches were studied.

4.3 Data Collection

The interviews of the people in the field of waste management were conducted in Lusaka during the period 25th - 26th of April 2017. Interviews were made based on an open questionnaire which is shown in the Appendix 1 (1/2). Everyone was asked the same questions privately. During the interviews, also complementary questions and comments came up and were discussed. In addition to taking notes during the conversations, the interviews were also recorded and written out afterwards.

Since the interviews were open, it was possible to easily take up into discussion any possible concerns. On the other hand, since each interview was different, making conclusions was not so clear. The interviews were conducted in English, making some misunderstandings possible, since it was not the mother language for the researcher nor for all the interviewees. Indigenous languages are more commonly spoken in the compounds than English. Answers were relatively trustworthy, and a lot of concerns came up, but there was also a slight possibility that not all the issues were raised up to the discussion, due to resentment.

Interviews of the residents of Ng'ombe compound based also on an open questionnaire which is shown in the Appendix 1 (2/2). Interviews were conducted on 11th of May at the aggregation center. Interview draft was in English, but most of the residents interviewed were not speaking English fluently, so there was a person, not professional translator, helping to conduct the interviews by translating the conversation. Possibilities for misunderstandings were higher than in interviews made in English since the comments

needed to be translated, but on the other hand, questions were more simple and answers were easily analyzed.

The numerical data used in this research was recorded by the Resolve Systems Limited. They have collected data about transportation of recyclables from buy-back center to the companies since February 2016. This data includes types, amounts and transport dates of the recyclable material. Moreover, they have collected data of the separated waste in Radisson Blue -Hotel including information of types and amounts of recyclables collected each month.

The recyclable material has been weighted with a scale at the aggregation center and then measurements were written down immediately. Money has been given by cash and recorded on the paper right away. Later on, the information has been saved into a computer. Resolve Systems Limited way of measuring seems valid and reliable but recording could be more effective and even straight to the computer to avoid mistakes while typing the data and handling many paper documents.

5 CASE OF NG'OMBE-COMPOUND

Ng'ombe is a compound in Lusaka City with population more than 34.000. Number of households is approximately 6.044 and average household size is 5,6 people per household. (LCC - A Report on the Status of Unplanned Settlements in Lusaka, 2006.)

Population of the settlement is growing very fast due high birth rates and immigration from other areas (LCC - Community Profiling Survey of Nine Unplanned Settlements, 2010). Probably the population has grown significantly since 2006.

According Mr. Kalolo there are some estimations of the current situation made by the Ward Development Committee (WDC). It says that today's population of Ng'ombe is as much as around 92.000 inhabitants. Average household size is estimated to be around 11 persons per household. Of the population 45% the residents are women, 32% men and 32% are under aged people.

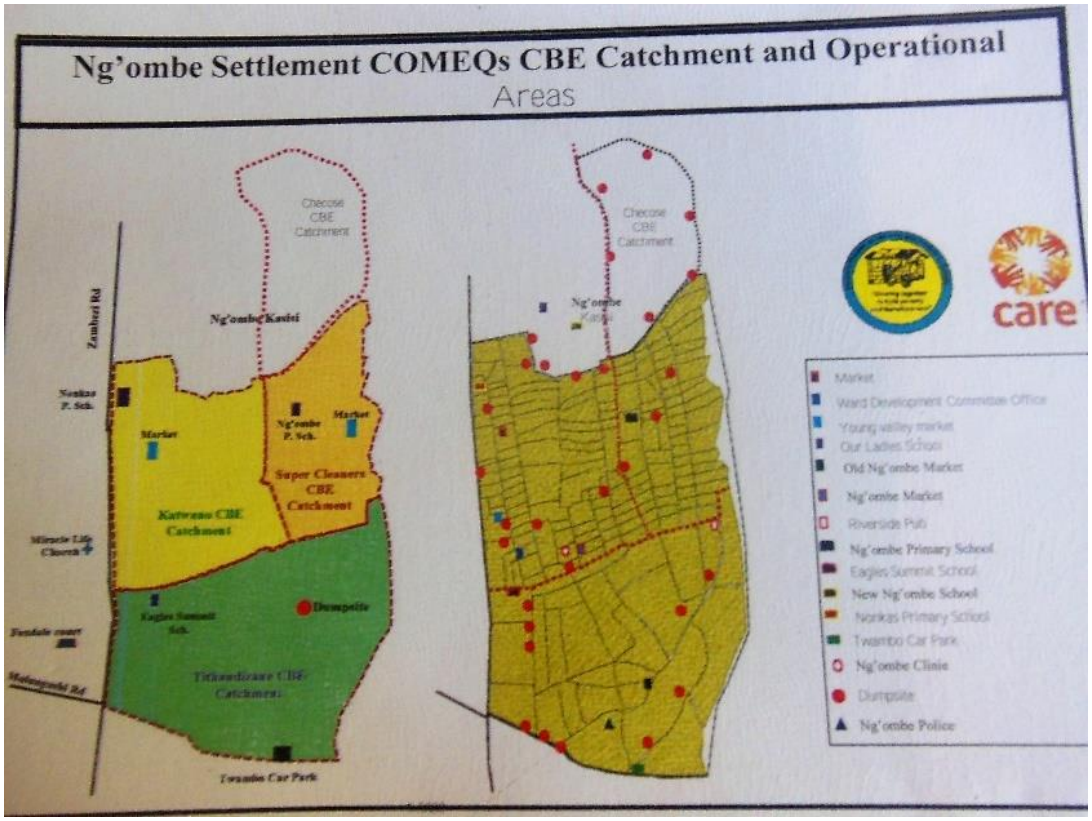
Area of Ng'ombe is about 933.259,33 square meters and it is located about 10 km from the main post office and 3 km from the University of Zambia (UNZA). It is surrounded by Kalundu to the south, Chudleigh to the east, Chamba Valley to the north and Roma to the west. (LCC – Community Profiling Survey of Nine Unplanned Settlements, 2010.)

Many houses are built close to each other and made of mud bricks, which easily collapse during heavy rains causing damage to property. Most of the houses are not connected to the electricity and the residents depend on charcoal and firewood for cooking. The residents of Ng'ombe are mostly involved in informal employment, for example maids, bus drivers, gardeners or selling groceries, food stuff and charcoal along the road sides and market. (LCC – Community Profiling Survey of Nine Unplanned Settlements, 2010.)

5.1 Waste Management

Based on the interviews, waste is not managed well in the Ng'ombe area. Still, the system is better compared to many other compounds and some even call that Ng'ombe is a clean compound. The system is there and the waste is managed somehow but there are still several challenges.

According the director of Kutwano CBE, Beatrice Kafue, Ng'ombe-compound is divided into four separated waste management areas and currently there are four CBEs operating; Kutwano CBE, Super Cleaner CBE, Titwandikaze CBE and Checose CBE. Each CBE is responsible for the waste collection in their area. They do both, primary and secondary collection. Previously they were doing only the primary solid waste collection. The waste collection areas are shown in the Picture 10. below.



Picture 10. Waste collection areas in Ng'ombe-compound.

The primary collection is done by collecting waste from households, schools and business premises using pushcarts. The collected waste is placed to a container which is emptied by the LCC and the waste is transported to the Chunga landfill.

For the secondary collection, there is one truck provided by the Care Zambian International and each CBE is allowed to use it for three days, every other week. With the truck, CBEs collect waste from households, school and business premises and transport those straight to the Chunga landfill.

According to Ms. Kafue, waste is managed old-fashioned way; everything is mixed and brought to the dumpsite. System is not good, since dumpsite is full and there is no space to store all the waste, including recyclable material, she said.

One of the challenges identified in the Ng'ombe waste management was the waste collection fee. Since people in the compound were suffering of poorness, they were trying to avoid paying the waste collection fees. Regarding the laws, it is prohibited to dig a pit for waste, burn waste or dump illegally to open areas and drains. But since laws are not supervised well enough, there was showing a lot of illegal dumping in Ng'ombe.

It seems that the LCC's capability to employ health inspectors for the compound has been limited and they were facing challenges like lack of vehicles and transport. Therefore, they were not able to supervise the waste management in the compound well enough. Mostly they make an inspection visit only when someone made a complaint.

People have also come up with productive ways to dump waste illegally. According to Mr. Kalolo, some people in the compounds prefer paying small amounts of money to mentally retarded people to dump their waste illegally during the nights, on behalf of them. Amount that they pay to these people might vary between 1-2 Zambian Kwachas (ZMK) when the collection fee could be as low as 5 ZMK per collection time. One ZMK is approximately 0,10 EUR (XE Currency Converter, 2017).

Another way of illegal dumping was doing laundry, especially blankets, in a river and hiding garbage to laundry packages and disposing it while doing laundry, without no one seeing. This kind of waste disposal is difficult to find out. Since many people are dumping illegally, the others are not willing to pay either. It is impossible to know, after dumping, from whom the waste came from, Mr. Kalolo said.

According to Ms. Kafue, another challenge in the waste management is secondary collection by the LCC. Waste was not collected the way it should be, due to the lack of equipment and inefficient collection system.

Third challenge, according Ms. Kafue, was lack of transport by CBEs. They could manage waste collection and transportation to the landfill more effectively by themselves, if they had more transport equipment, for example trucks.

5.2 Recycling

During the research period, there were introduced few recycling initiatives to focus on by Mr. Kalolo. The initiatives dealing with recycling in Ng'ombe were Manja Pamodzi, Radisson Blue -Hotel recycling, Foxdale Court –shopping complex recycling and CBE-recycling. According Mr. Kalolo, recycling was growing and direction is correct but the situation was still far away from ideal.

Manja Pamodzi

The biggest initiative in Ng'ombe was Manja Pamodzi -program. It started in this area December 2015. District clean-up event was held and since then, registered collectors have been collecting recyclable waste from the drains and streets and all around the area on daily basis. They collect certain recyclables, for example plastics, and aluminum and sell those to the company called Resolve Systems Limited.

Picture 11. Pushcarts with collected recyclables.

Manja Pamodzi provided bags for collectors in first place but when the collectors started to make more money, they bought more bags for collection by themselves. There were also pushcarts, that could be borrowed from the collection point, for the delivery of recyclable material provided by the project. Originally there was five pushcarts given by Manja Pamodzi, but during the visit there was only two pushcarts in operation, since the others were broken. An example of the material transport with a pushcart can be seen in the Picture 11. above.

When the collectors brought in their collected recyclables, those were weighted and recorded to the system as can be seen in the Pictures 12. and 13. below. Price, that the collector gets, was based on the material and weight. All the data was recorded to the collection sheets, including information who collected, when, which materials, how much and how much money was paid.

Picture 12. Weighting recyclables.

Picture 13. Recording the data.

Earlier, there used to be an electronic payment system using Airtel-money over mobile phones. Airtel is a local telecommunication company. The payment system did not work

because many of the collectors are older women who do not have a mobile phone or do not even know how to use it. At the moment, payments were made by cash immediately after delivering the recyclables. Trusted collectors might have even received an advance payment in special occasions. Buying prices from the collectors and selling prices to the companies are presented in the Table 2. below.

Table 2. Material prices (Mr. Kalolo, 25th of April 2017).

Material	Buying price ZMK/kg *	Selling price ZMK/kg
Clear plastics	0,50	0,80
Brown plastics	0,25	0,60
HDPE - plastics	0,50	1,0
PP - plastics	1,0	3,0
Aluminum	1,0	5,0

* 10 ZMK is approximately 1 EUR (XE Currency Converter, 2017).

Resolve Systems Limited is a company established 6th of May 2015. They work as aggregators of recyclable material. The company co-operates with Manja Pamodzi program but they bought recyclable waste from other sources as well, for example CBEs. After collection, materials were separated to the piles at source waiting for collection. Then materials were sold to the recycling companies in co-operation with Manja Pamodzi.

The aggregation center was funded by Manja Pamodzi, and there they had a storage where the recyclables were collected. Storage and collected and sorted recyclables waiting for a pick-up can be seen in the Picture 14. below.

Picture 14. Aggregation center.

Radisson Blue -hotel Recycling

In addition to aggregation center, Resolve Systems Limited had established a co-operation with Radisson Blue -hotel. They had started separating waste from all the mixed waste generated at the hotel. During the research visit, there were two people separating the waste at the source in the waste room. Radisson Blue -hotel pays the company a fixed price per month, minus the value of the recyclables that they collect. The recyclables from the hotel were taken to the same aggregation center, from where those were sold further to the recycling companies. Co-operation between Resolve Systems Limited and the Radisson Blue -hotel started in June 2016.

The Zambian Environmental Management Agency (ZEMA) was considering to establish a law that all the business premises shall take more responsibility of their own waste as a way of corporate social responsibility. By the law, businesses need to establish separation systems and the aim of the Resolve Systems Limited -company is to start co-operation with other hotels and business premises as well.

Foxdale Court –Shopping Complex Recycling

Foxdale Court shopping complex was built in 2012 and there operates many companies. Their way of recycling is to separate waste at source to the different bins. Waste management system is run by Waste Recycling Manager, Mr. Kasangila Sabe. At the time of the visit, there were bins for different wastes with different color codes everywhere around the complex. An example of the bins can be seen in Picture 15. below. Next to the bins there was also clear instructions how to recycle. The instructions are shown in the Picture 16. below.

Picture 15. Recycling bins.

Picture 16. Recycling instructions.

Waste was separated to the bins separately for paper, plastic, food waste and other waste. Paper was collected by Zambezi papermills producing new products from the recycled paper. Plastics was collected by Habib enterprises producing new plastic bottles. Food waste was composted by JK Series Units and used into gardens around

Foxdale Court complex. In addition, printer ink cartridges were collected by Green cartridges and refilled as new cartridges.

Community Based Enterprise (CBE) Recycling

In addition to these programs, the CBEs are interested in starting the recycling, especially Kutwano CBE. They have tried to encourage people to recycle but people has been discouraged by the price of the recyclable material.

At the time of the research visit, they got separated waste from few households when doing primary collection. Kutwano CBE does not have a storage place for recyclables so the material is stored at Ms. Kafue's backyard. Later, when they had collected some amount of the recyclables they sold those to the Resolve Systems Limited.

Kutwano CBE was also interested in separating collected mixed waste before disposing it to the landfill but they did not have any space for the waste separation.

6 RESULTS AND FINDINGS

6.1 Evaluation of Recycling Effectiveness

Recycling in Ng'ombe has gone a lot forward through the initiatives. However, the effectiveness of the recycling initiatives is not too good due to the many challenges. Based on the interviews and numerical data, effectiveness of the actions of each initiative are evaluated in this chapter by the people interviewed.

Manja Pamodzi

According to Mr. Kalolo, Manja Pamodzi has been effective so far and it is also supposed to continue even when the funding will end at the end of year 2018. When choosing the aggregator to the pick-up point, a person with a good business mind was searched for so that he would be able to use the provided space to make profit. Since the Resolve Systems Limited is making profit with collecting recyclables and a little bit of other business, it supports the continuity of the program.

Also, Ms. Kafue and Mr. Kalolo agreed that effectiveness of Manja Pamodzi was high and collectors have been in an important role when making Ng'ombe cleaner place to live. It was the biggest recycling initiative in the area and the collection, especially close to buy back center has been really effective, according to Ms. Kafue.

Radisson Blue -Hotel

Waste separation and recycling in Radisson Blue hotel was not so well known among the other people interviewed, but regarding Mr. Kalolo, it has been a really good project. Recycling has been effective there and Resolve Systems Limited would be willing to create a similar system for other hotels and business premises as well. Below in the Figure 4. is shown segmentation of the collected and separated waste at source since the program started in June 2016. Data was given by Mr. Henry Kalolo and it is recorded by the company Resolve Systems Limited. It is also shown in original from in the Appendix 2.

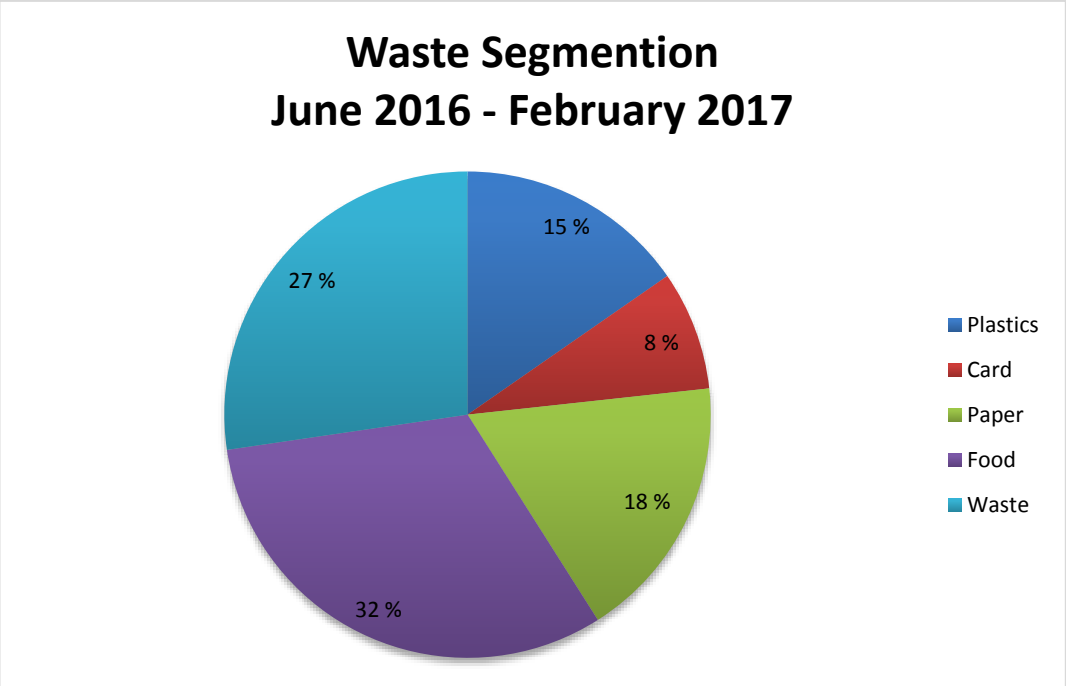


Figure 4. Waste segmentation in Radisson Blue-hotel.

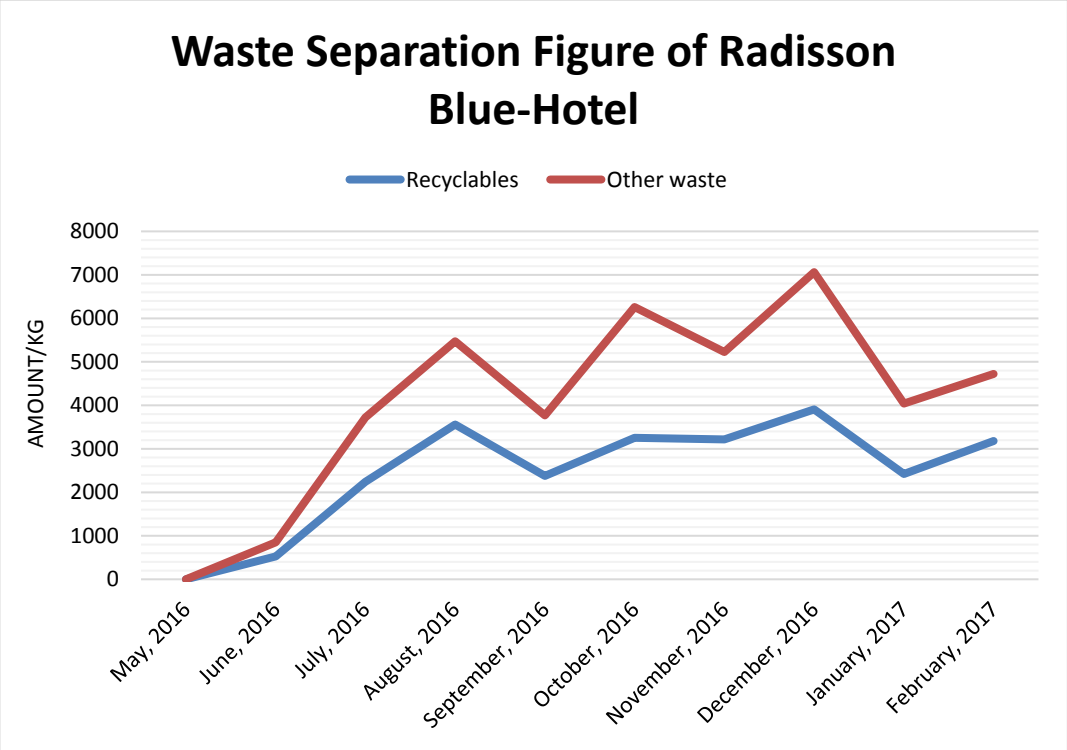


Figure 5. Radisson Blue-hotel waste separation.

Obviously, at the time of visit more material has been recycled than before the program started, since there was no separation at source then. The monthly development of the amount of waste and recyclables generated at the hotel can be seen in the Figure 5. above.

Foxdale Court

Foxdale Court, according to Mr. Mulenga, was the first eco-friendly building in Lusaka City. They are self-sufficient and contact other companies only in special occasions. At the time of research, they had their own people collecting recyclables from the complex. In addition, they had a composting system for organic waste at the backyard of the complex shown in the Picture 17. below. According to Mr. Mulenga, all the businesses should follow the example of Foxdale Court and create similar kind of recycling systems. Also Mr. Kalolo agrees that their system has been very effective.

Picture 17. Composting systems in Foxdale Court.

CBE Recycling

CBEs in the Ng'ombe area, especially Kutwano CBE, are trying to increase recycling but at the time of the interviews it had not started so well yet, and only few households separated the waste. But since the recycling is a subject that was talked about everywhere often, it would be only a matter of time when people would start separating their household waste, said Ms. Kafue.

6.2 Data Analysis

Data of the collected materials by the different initiatives was not available. Therefore, in order to analyze the recycling efficiency numerically, data recorded at the aggregation center has been used. Data was given by Mr. Henry Kalolo and is shown the Appendix 3 in original form. It was modified and analyzed by the author.

In addition to data of the materials collected by Manja Pamodzi collectors, the total data included also materials brought from Radisson Blue -Hotel, as well as CBEs but excluded the materials collected at the Foxdale Court.

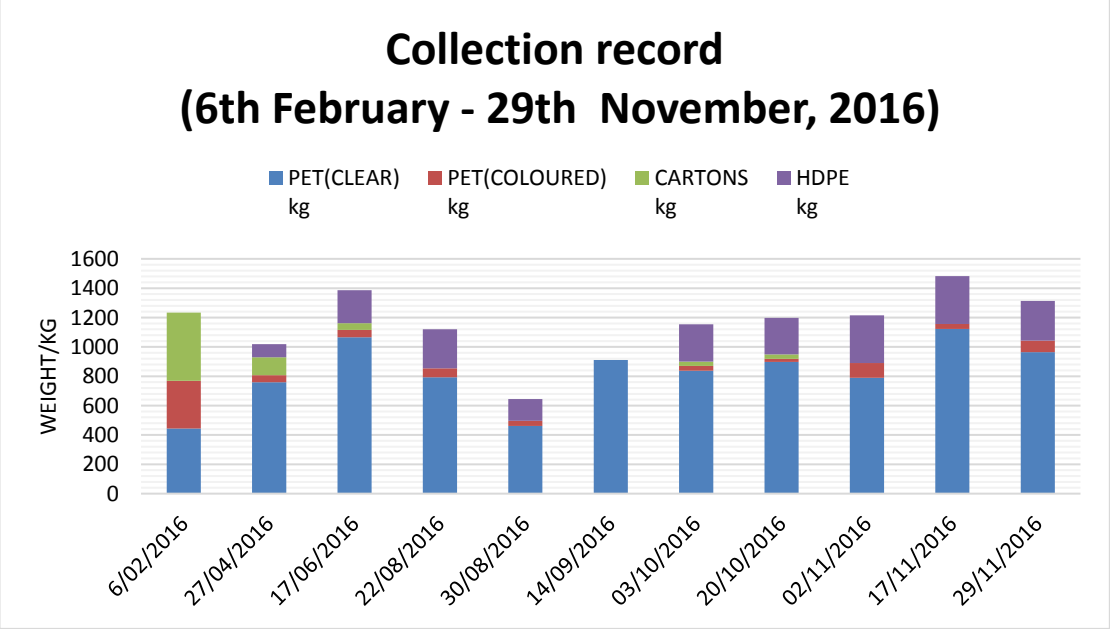


Figure 6. Collection record from the aggregation center.

In the Figure 6. above there is shown the development of the material collection from the aggregation center to the recycling companies. The vertical axis shows the collection dates from February to November 2016. The horizontal axis describes weight of the materials in kg. In addition, different materials can be identified by color, i.e. clear plastics are blue, colored plastics red, cartons green and HDPE plastics purple.

From the Figure 6. can be seen that the amount of materials collected increased during the time period. In the beginning, February to June, the amount looks similar at a quick glance, but it is to be noted that then material was collected only every other month. Later on, from August forward, the columns are slightly higher and collection has been done several times per month. Therefore, from this figure can be concluded that the material collection efficiency has improved during the period, and the materials were collected from aggregation center remarkably more often that in the beginning.

The Figure 7. shows that most common collected material was clear PET plastics followed by HDPE-plastics; clear PET- and HDPE- plastics together were 88% of all collected materials and cartons and colored PET-plastics were only 6% each. More detailed segmentation of the collected materials is presented in the Figure 3. Below.

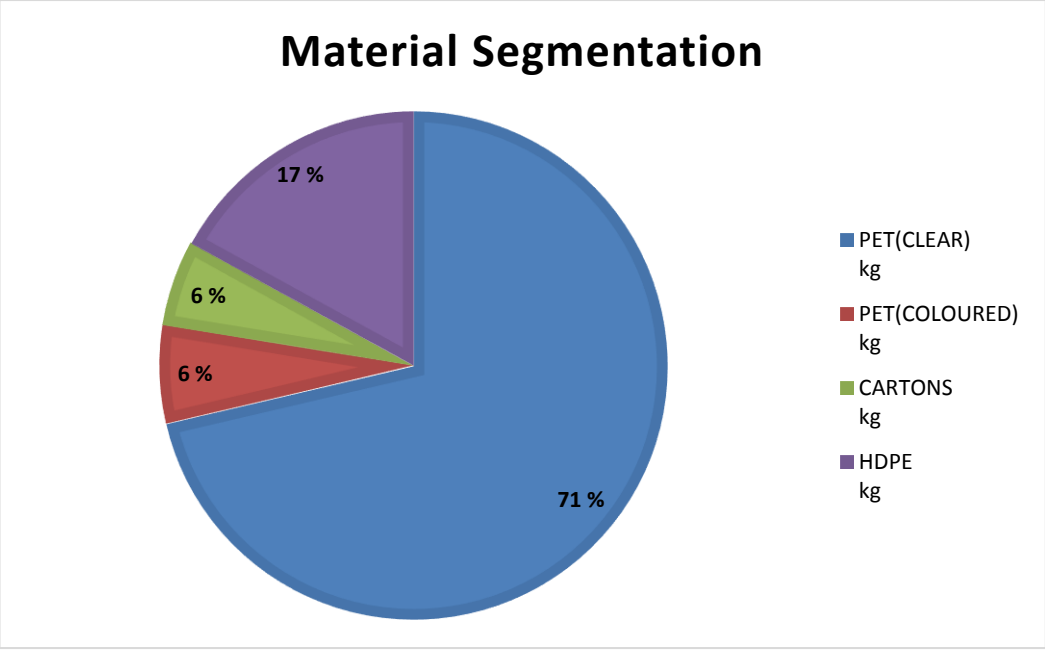


Figure 7. Segmentation of collected recyclables.

6.3 Impact

Based on the interviews and recorded data, the amount of recycled materials had increased through the programs. One reason for the positive result was that now people knew where they could bring recyclable material and even get paid for it, according to Mr. Kalolo.

For the environment, recycling projects have had a positive impact. It could be noted when moving around the compound, that there was less plastic around the streets than there used to be, according to Mr. Kalolo. Environment is getting cleaner, better and nicer for the residents, noted also Ms. Kafue.

Recycling business in Ng'ombe had also improved since people realized a possibility to make a living out of recyclables, says Ms. Kafue. Apparently, business for recycling companies had developed positively as well, since less material was transported to the landfill and more to the recycling companies than before.

Mr. Kalolo told, that Resolve Systems Limited - company was showing signs of improvement as a business through the initiatives. At the time of interview, they had four workers and they made more profit than before. Mr. Kalolo continued that they could still do a lot better if they could handle bigger volumes. Once they were be able to get a transport system, they would be really efficient.

Based on the interviews, the recycling initiatives, especially Manja Pamodzi, have made a huge impact to the residents. Mainly because the collectors have been able to make money out of recyclables and it has changed their lives in a positive way. Some collectors have been able to send their kids to school thanks to the money they have made out from the recycling. Also, people have been able to develop other businesses by collecting material for recycling. For example, some were selling food and they used plastic as a source of income so that they could buy raw materials for selling at the market, explained Mr. Kalolo.

Thus, significant financial advantages for the residents became apparent. But in addition to making money, people were employed through the programs, so they had something purposeful to do in their lives. The recycling initiatives have been really successful, especially for women and children, said Mr. Mulenga.

The interviewed residents were happy that there was more recycling done in the area. Still, they were not completely satisfied with the recycling system in place. Even more could be done and programs should continue. Residents were aware of Manja Pamodzi project, as well as separated bins at the Foxdale Court. Some had also noticed CBEs doing material separation after the primary collection.

Residents had realized changes in the environment as well. According to them, the environment has become cleaner, but mostly close to the aggregation center. Areas further away were still in the same condition as in before the initiatives. Also, waste burning had reduced and the amount of waste on the streets and drains had reduced notably.

According to the residents interviewed, not all the people are aware of the possibility to sell the recyclables, especially people not living close to the aggregator center. Nevertheless, they knew that people were collecting materials and earning money out of it. According them, it has been good system for the residents to make some income.

6.4 Challenges

Recycling has increased due to the initiatives introduced earlier, but according the interviews and observations, there were still several challenges in the field of recycling in Ng'ombe. First of all, it seemed that the people were not aware of the value of the waste they are generating. Every interviewed person shared the opinion that people's attitude towards waste management and recycling was not good and it is extremely difficult to change, especially adults.

Even if some people had started making their living out of the waste collection, mostly waste business was seen as a dirty occupation and not appreciated among the people, said Mr. Kalolo. In addition, people are not educated enough on recycling and waste separation and it became clear that schools were not teaching the importance of recycling.

Therefore, the waste separation was challenging, since people were not separating the waste at source at households, and separation was done only after dumping. Even if people were willing to separate their household waste, there were no containers provided for different types of waste, but that was not simple either. Challenges for putting up waste containers were that recyclable materials from containers would be stolen,

according to Ms. Kafue. If there were waste containers, those should be locked continued Mr. Mulenga.

Recycling initiatives in Ng'ombe also faced several financial challenges. There was no money to buy bigger vehicles to transport bigger volumes of recyclables. Currently, according to Mr. Kalolo, they were not even able to afford repair of broken pushcarts (30 ZMK/3 € each). In addition, there was not enough bags provided for collection said Ms. Kafue.

One of the biggest challenges was also low price of the recyclable materials, which was determined by the recycling companies. It was low since volumes were small and most of the materials were shipped abroad for the manufacturing. In addition, there did not exist big glass recycling company in operation in Lusaka, which was the reason that glass was not collected in Ng'ombe at all.

Current price paid for the recyclables was not motivating people to collect all the material from the streets. The workload was huge to collectors; they had to collect and transport big volumes of recyclables to earn even some income. Moreover, the distances also cause challenges because Ng'ombe is a big compound. People on the other side of the compound were not able to bring recyclables to the buy-back point, since it was too far, Mr. Kalolo said.

Here is an example of the low price of material: One of the best Manja Pamodzi collectors had been collecting the materials for five days. The pushcarts had to take six loads to transport all the materials to the aggregation center. The price she got for this amount of material was only 47 ZMK (4,7€). Material consisted mostly colored plastics.

From that money, she also needed to pay to the people who transported the materials to the aggregation center on her behalf. According to her the price of the material was way too low, and it would not be possible to focus only on collecting recyclables. She needed to do other business or work as well. According to her, workload was also huge and transport system was lacking. There was no truck in use so that the aggregator would be able to come and pick up the recyclable material when it had been collected.

Below in the Picture 18. is shown the materials collected and transported to the aggregation center by the collector.

Picture 18. Collected materials by Manja Pamodzi – collector.

When it comes to challenges in CBE-recycling, price paid from recyclables was not enough to hire people to do separation of the waste after the primary collection, according to Ms. Kafue. The other challenges when trying to implement CBE recycling were lack of space to store recyclables and to separate the waste. One issue related to separation was also that collectors from Manja Pamodzi were going through the recyclables from the containers where people dump their waste, according Ms. Kafue.

There were also challenges in recycling of the organic waste. It contains a lot of liquid which makes it heavy to transport. Also, related to organic waste, there was no space, for example farmland outside the city, where the composting could be done.

7 SOLUTION PROPOSALS

7.1 Recommendations for Current System

It seems that recycling has increased in the Ng'ombe compound and the initiatives have been effective, especially Manja Pamodzi and Foxdale Court -complex have been praised a lot. It is good that there are ongoing initiatives and people interested in recycling but since the system is not ideal, some ideas have been identified during the research how to improve the system so that the initiatives would be more effective, and how to increase the recycling in all the three aspects; economic, environmental and social. Some actions should be done in order to achieve the aim of recycling and proposals are made based on the challenges that were found out during the interviews.

First of all, cost of repairing pushcart was relatively low compared to the impact they make for the collection effectiveness. It would be good to repair pushcarts and keep those in good condition meaning e.g. that not too big loads should be transported at once. In addition to the pushcarts, also some other equipment would be needed. Other equipment needs that came apparent were; more bags for waste collection and more vehicles for waste transportation. Those would make an immediate impact in recycling, since it has been challenging to transport big loads of materials, especially for long distances.

There would be also several spaces needed to increase recycling effectiveness. Ideas for the spaces that could be provided and that would make positive changes to the recycling in the Ng'ombe compound are following:

- Another collection point on a strategic location on the other side of Ng'ombe
- Storages for the recyclables collected from households for CBEs
- Space for the waste separation to CBEs
- Farmland for the composting to recycle organic waste.

Another collection point would be good for the people living in the other side of Ng'ombe and by implementing that, the environment over there would get cleaner and better as well. In addition, there would be financial advantages for the residents also on that side.

Storages for CBEs are really important, since it is not reasonable to keep waste material at your own backyard, the way Ms. Kafue is doing. Waste separation space and farmland for composting would add the effectiveness of recycling as well.

To change people's attitudes, awareness of the recycling should be increased. People should learn the basic idea behind the recycling, advantages of it and how to separate waste. The information should be spread widely. Here are few ideas how to increase the awareness:

- CBEs could deliver flyers to households with basic instructions
- Information about recycling spread in radio, TV, newspapers and social media
- Teaching of recycling at schools/public events/churches
- Putting up colored separated (locked/supervised) bins for different types of waste with instructions to public places, markets and business premises.

It is quite easy and relatively cheap to make flyers and when seeing those, people would start to think about recycling even subconsciously and possibly they would be able to make some positive changes in their behavior. Same changes would be happening when people would notice information about recycling in the media like radio, TV and newspapers and also in social media. For example, Airtel telecommunication company provides unlimited Facebook with certain price for daily, weekly and monthly usage, which is really common and could be good template to promote recycling.

Schools are good places to educate children, and children usually keep talking at home even after the classes about the new things they have learnt at the school. But when trying to increase recycling also among the adults, it would be good to include some information sharing to public events and churches. Over decades, church has been influential place to educate people and it could make a huge difference on people's minds about recycling.

Later on, if there would be provided bins for different types of waste, when trashing, people would realize that not all the waste belong to the same bin. They would start thinking, where to put certain wastes, especially if the instructions would be provided next to the bins. At the moment, the bins should be locked or supervised, since there are collectors collecting the materials and selling those to the aggregation center, so obviously, the bins would be emptied by the collectors, if not controlled.

Also, people should be encouraged to start waste separation. Easiest way to change behavior is to motivate people financially. Encouragement could be done for example in the following ways:

- Reducing waste collection fees for the households who separate the waste
- Awarding the companies who do recycling by reducing some fees
- Refund of the recyclable products, which would be paid back when returning products to stores

When residents or companies would see some financial advantage of separating the waste, they would be more motivated. Or even, when seeing other people or companies getting awarded somehow, they would like to achieve the same advantage and follow the example.

In many countries, all over the word, there is a small add-on in the price of recyclable materials like plastic bottles, glass bottles, cans, which would be paid back when returning the materials back to the store. That is efficient way to collect the materials back for reuse and to ensure that people are not trashing those among all the other waste, since they have paid that add-on and want to get the refund accordingly.

While interviewing, a common opinion was that people would be able to separate the waste, if they were advised how to do it and for example were given the bags with different colors for different types of waste. If that kind of system would be implemented, the collection could be done by collecting different types of waste on certain days, for example, organic waste on Mondays, plastics on Tuesdays, glass on Wednesdays. That idea would be worth trying and costs would remain relatively low.

7.2 Long-term Goals

Ideal situation in long-term would be that people would learn the importance of recycling and separate their waste by source automatically in the households while containers for different types of waste could be located to strategic positions, so that people could deliver their recyclables straight to the collection points. From the collection points, recyclables would be transported easily to recycling companies and the chain from households to the companies would be a lot more effective.

To get there, increasing awareness among the people should be done also by the governmental sector. The Ministry of Education should decide to include in the education plans teaching of recycling in schools. In addition, the enforcement of the laws related to the whole waste management system should be improved, so that waste, recyclables and nonrecyclables, would not be all over.

It would be important to support the private sector recycling companies, who are passionate about increasing the recycling and making money out of it. They would do a lot of effort to make recycling work since their income would be based on it. They are the ones who are able to make positive changes. For example, providing a truck to a passionate aggregator would make a big impact since the volumes would increase and recycling systems could be implemented to many business premises.

Price paid for the recyclables could be increased by establishing and utilizing Zambian recycling companies. They would be able to produce new items right here in Zambia with cheaper price than companies who send material abroad for manufacturing. Local companies would also increase the employment rates and they could be more caring about the environment. There is a need especially for glass recycling companies, since currently there is none. It would be good to start collecting recyclable glass and produce it to new items.

One idea to improve effectiveness of recycling would be a system to force people to pay for garbage and make people to separate the waste by source. For example, garbage fee could be included in electricity bill. But currently the enforcement of the law is not effective and also there is quite a lot of corruption in Zambia, so it would be difficult to force people to pay and promise that money they are paying would go to the purpose it is collected for.

When the waste management and recycling systems come more efficient it would be good to come up with more creative uses for waste and possibly even start making energy out of waste.

8 CONCLUSIONS

It can be seen, that there are many challenges in the field of waste management and recycling in Zambia. The laws and regulations that support waste management exist but the enforcement is not good enough which leads to several issues. Without improving the enforcement of the law, it is impossible to create a functional system. In addition, the strategies should be updated, since following the old strategy is not reasonable any more. Documents should be updated on a yearly basis in order to get some progress.

Even if recycling is common and increasing worldwide and a way to promote green and sustainable environment, recycling has not been too effective yet in Lusaka. However, in Ng'ombe compound there are several people and companies trying to increase the level of recycling and the direction is correct. Already the current recycling initiatives have made a positive impact and changed the environment, business as well as residents' lives.

Still, there is a long way to go, in order to build an effective recycling system, as exists in developed countries. Main change required would be to change people's minds by teaching the importance of recycling and possibilities to make money out of it.

Despite the many challenges and issues, at least many good steps have been taken towards a greener future. It seems that The City Council is willing to increase the effectiveness of the recycling and looks forward to implement new initiatives. Hopefully many new initiatives will follow soon and Lusaka becomes a clean and sustainable city with effective recycling and waste management systems.

All in all, I am looking forward to see some changes in the field of recycling and waste management in Lusaka in the near future. Aim of this thesis was to understand the current situation and find out solutions how to improve the system further. Challenges and impacts were found as well as improvement ideas. Therefore, project was accomplished successfully.

In addition to research findings, this experience has been really rewarding and educational. I am so thankful for the opportunity to work among these issues in Zambia and hopefully I will be back some day and I will see some progress.

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Interview

Questions to key persons:

1. Name, occupation, contact details?
2. How long have you been working in the field of waste management?
3. How is the waste managed in Ng'ombe?
    - What is good?
    - What are the challenges?
4. What is your role in recycling in Ng'ombe?
5. Current situation of recycling in Ng'ombe?
    - What recycling initiatives there exists?
    - What is good?
    - What are the challenges?
6. How effective the recycling of the following initiatives has been?
    - Manja Pamodzi - project
    - Radisson Blue – hotel
    - Foxdale Court
    - CBE – recycling
7. Has the recycling done in Ng'ombe increased since the programs started?
8. Has the recycling brought change in the community?
9. If yes, what kind?
    - Recycling business
    - Residents
    - Environment
10. Are you happy with the current system?
11. What would be needed to make recycling more effective?
12. Other ideas/comments?

Questions to residents:

1. Name, age, occupation?
2. Current situation of recycling in Ng'ombe?
    - What is good?
    - What are the challenges?
3. Have you heard about following initiatives?
    - Manja Pamodzi - project
    - Radisson Blue – hotel recycling
    - Foxdale Court recycling
    - CBE – recycling
4. Do you think those have brought change into the community?
5. If yes, what kind?
    - Recycling business
    - Residents
    - Environment
6. Are you happy with the current recycling systems?
7. What could be done better?
8. Other ideas/comments?

Collection Data, Radisson Blue-hotel

(Henry Kalolo, Resolve Systems Limited, 2017)

TRASHBACK	Comprehensive Radisson Blu waste removal record sheet						info@trashback.org
Date	PET kg	HDPE kg	LDPE kg	Card kg	Paper kg	Food kg	Waste kg
June, 2016	77,3	5,3	90,8	106	248,22	853,8	322,31
July, 2016	204,8	22,8	561,61	322,3	1128,7	2153,6	1481,92
August, 2016	487,6	120	878,3	582,9	1489,1	1827,5	1913,6
September, 2016	396,28	125,12	627,32	526,13	702,56	1316,53	1392,29
October, 2016	886,19	318,83	317,97	873,27	856,54	2245,55	3009,2
November, 2016	81,6	34,6	860,8	464,04	1775,7	2662,7	2010,5
December, 2016	174,7	13,7	1220,3	654,8	1843,5	3108,2	3155,9
January, 2017	167,8	161,1	364,9	535,2	1193,1	2068,56	1618,24
February, 2017	251,51	524,57	261,8	712,24	1429,67	2843,09	1542,28
TOTAL	**2727,78**	**1326,02**	**5183,8**	**4776,88**	**10667,09**	**19079,53**	**16446,24**

Aggregator Monthly Collection Sheet

(Henry Kalolo, Resolve Systems Limited, 2017)

TRASHBACK		Aggregator Monthly Collection Record Sheet				info@trashback.org	
Date	**Time**	**Operator Name**	**Collector Name**	**PET(CLEAR) kg**	**PET(COLOURED) kg**	**CARTONS kg**	**HDPE kg**
6/02/2016		Gabbey	Harrison	444,15	324,95	464,55	
27/04/2016		Gabbey	Harrison	759,3	48,35	121,75	89,8
17/06/2016		Gabbey	Harrison	1065,95	49,8	46,1	224,7
22/08/2016		Gabbey	Harrison	793,3	60,5		266,65
30/08/2016		Gabbey	Harrison	461,28	34,55		148,89
14/09/2016		Gabbey	Harrison	910,42			
03/10/2016		Gabbey	Harrison	837,7	32,3	30,2	253,4
20/10/2016		Gabbey	Harrison	897,8	20,8	30,35	249
02/11/2016		Gabbey	Harrison	790,03	100,15		324,9
17/11/2016		Gabbey	Harrison	1122,3	33,65		326,8
29/11/2016		Gabbey	Harrison	964,4	78,65		270,3
TOTAL				**9046,63**	**783,7**	**692,95**	**2154,44**